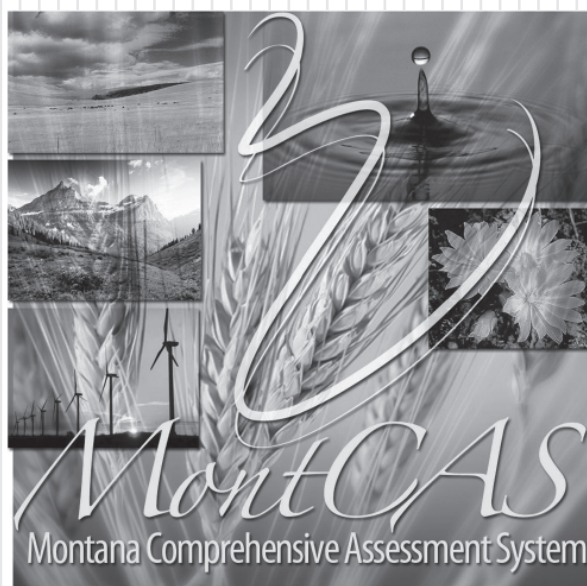


# *Montana Comprehensive Assessment System (MontCAS CRT)*

GRADE 10  
COMMON RELEASED ITEMS  
SPRING 2015



[opi.mt.gov](http://opi.mt.gov)

Montana  
**Office of Public Instruction**  
Denise Juneau, State Superintendent

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# Science Directions

This Science test contains three test sessions. Mark or write your answers in the Answer Booklet. Use a pencil to mark or write your answers.

This test includes two types of questions: multiple-choice and constructed-response questions.

For the multiple-choice questions, you will be given four answer choices—A, B, C, and D. You are to choose the correct answer from the four choices. Each question has only one answer. After you have chosen the correct answer to a question, find the question number in your Answer Booklet and completely fill in the circle for the answer you chose. Be sure the question number in the Answer Booklet matches the question number in the Test Booklet. The example below shows how to completely fill in the circle.

CORRECT MARK	INCORRECT MARKS
<input checked="" type="radio"/>	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/>

If you decide to change your answer to a question, erase the wrong mark completely before filling in the circle of the new answer. Be sure you have only one answer marked for each question. **If two circles are bubbled in for the same question, that question will be scored as incorrect.**

If you are having difficulty answering a question, skip the question and come back to it later. Make sure you skip the circle for the question in your Answer Booklet.

For the other types of questions in the Test Booklet, you will be asked to write your answers in the box provided. Read the question carefully. If a question asks you to explain your answer or to show your work, be sure to do so.

You may make notes or use highlighters in your Test Booklet, but you must bubble or write your final answers in your Answer Booklet. **Do not make any stray or unnecessary marks in your Answer Booklet.**

Let's work through a sample question together to be sure you understand the directions.

## Sample Question

1. What is the state animal of Montana?
  - A. elephant
  - B. giraffe
  - C. grizzly bear
  - D. zebra

# Science

1. A student observes rocks on a class field trip. Which information can the student infer from observing the size of mineral grains in an igneous rock?
- A. the identity of the parent rock
  - B. the relative cooling rate of the rock
  - C. the absolute age of the rock's grains
  - D. the depositional environment of the rock's grains

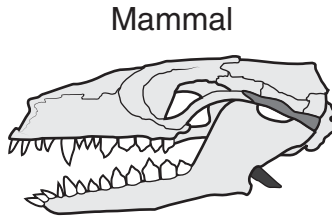
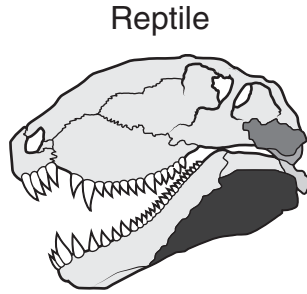
2. The instructions below were recorded in a student's lab notebook.

1. Fill six identical containers with the same amount of soil.
2. Choose six young, green bean plants that are the same height.
3. Plant one green bean plant in each container.
4. Pour 50 milliliters of water into each container.
5. Put three containers on a sunny windowsill and three containers in a dark closet.

Which hypothesis is **most likely** being tested by this experiment?

- A. Green bean plants need soil to grow.
- B. Green bean plants need light to grow.
- C. Green bean plants need water to grow.
- D. Green bean plants need a container to grow.

3. The diagram below represents the fossil jawbone features of a reptile and a mammal.



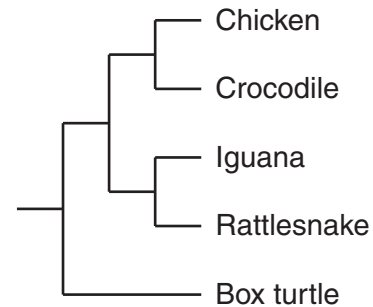
Based on the diagram, what does the fossil record **most likely** show about reptiles and mammals?

- A. evidence of a reptile extinction and an increase of mammal species
- B. evidence of a reptile and a mammal that had the same jawbone features
- C. evidence of a transitional species that was more successful over time than either reptiles or mammals
- D. evidence of related jawbone features of a reptile and a mammal

4. Which statement describes an electron?

- A. It has the same mass as a proton.
- B. It has the same mass as a neutron.
- C. It has a charge of  $-1$ .
- D. It has a charge of  $+1$ .

5. The diagram below shows evolutionary relationships.



Based on the diagram, which organisms are the **most** closely related?

- A. chicken and crocodile
- B. chicken and box turtle
- C. crocodile and iguana
- D. rattlesnake and box turtle

6. Students are researching the factors that might affect the time it takes for a moon to orbit its planet. This time is called the “orbital period.” The distance from a moon to its planet is equal to the radius of the moon’s orbit. The table below shows the data the students collected.

**Planet and Moon Data**

Planet	Relative Mass to Earth	Moons	Orbital Period (Earth days)	Radius of Orbit (1,000 km)
Jupiter	318	Andrastea	0.3	129
		Almathea	0.5	181
		Europa	3.6	671
		Callisto	16.7	1,883
		Elara	259.7	11,737
Saturn	95	Mimas	0.9	186
		Rhea	4.5	527
		Hyperion	21.3	1,481
Uranus	15	Miranda	1.4	130
		Ariel	2.5	191
		Oberon	13.5	584

- Select one planet and describe the relationship between the orbital period and the radius of orbit for the planet’s moons. Use data from the table to support your description.
- The students investigated whether or not a planet’s mass affects the orbital period of its moons. One student used Miranda, Rhea, and Callisto to conclude that more massive planets have moons with greater orbital periods. Explain in detail how to support or refute the student’s conclusion.

## Scoring Guide

Score	Description
4	Response demonstrates a thorough understanding of analyzing and evaluating a scientific investigation. Response describes and supports with data the relationship between the orbital period and the radius of orbit for one planet's moons, and evaluates the weakness of a student's investigation of the planet and moon data. Response contains no errors or omissions.
3	Response demonstrates a general understanding of analyzing and evaluating a scientific investigation. Response describes and supports with data the relationship between the orbital period and the radius of orbit for one planet's moons, and evaluates the weakness of a student's investigation of the planet and moon data. Response contains one error or omission.
2	Response demonstrates a limited understanding of analyzing and evaluating a scientific investigation. Response describes and supports with data the relationship between the orbital period and the radius of orbit for one planet's moons, and evaluates the weakness of a student's investigation of the planet and moon data. Response contains two errors or omissions.
1	Response demonstrates a minimal understanding of analyzing and evaluating a scientific investigation. Response describes and supports with data the relationship between the orbital period and the radius of orbit for one planet's moons, and evaluates the weakness of a student's investigation of the planet and moon data. Response contains one correct piece of information and contains several errors or omissions.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

## Training Notes

- a. For each planet, as the radius of a moon's orbit around a planet increases, the orbital period increases. For Jupiter, the radii of the moons' orbits increase from 129,000 to 11,737,000 km while the orbital periods increase from 0.3 to 259.7 days. For Saturn, the radii of the moons' orbits increase from 186,000 to 1,481,000 km while the orbital periods increase from 0.9 to 21.3 days. For Uranus, the radii of the moons' orbits increase from 130,000 to 584,000 km while the orbital periods increase from 1.4 to 13.5 days.

Using moons with the highest and lowest radius or any three moons of Jupiter is acceptable.

- b. The student (taking the test) should refute the student's (in the item) conclusion. The student (in the item) chose three moons with different orbital radii to conclude that more massive planets have moons with greater orbital periods. In order to make a valid conclusion, moons should be chosen with similar orbital radii. According to the data in the table, if moons are compared with similar orbital radii, then as the mass of the planet increases, the orbital period decreases. The student (taking the test) might also argue that using only two or three data points is not the best way to come to a conclusion, regardless of how similar the data are. Appropriate comparisons would be Andrastea and Miranda (the best comparison), or Almathea, Mimas, and Ariel.

Part (a) is worth 2 points, and part (b) is worth 2 points.



#### Example of Score Point 4

a) For Jupiter's moons, the greater the radius of orbit is, the longer the Orbital Period is. For example, Andrastra's radius of Orbit is 129 (1,000 km) and its Orbital Period is 0.3 days. But Elara's radius of Orbit is 11,737 (1000 km) and its Orbital Period is 259.7 days.

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b) This is not true because for the student's conclusion to be accurate, he should have used moons with relatively close Radius of Orbit. The moons he chose had radius of orbits of 130, 527, and 1,883. He should have chosen moons Ariel, Mimas, and Almathea, with radius of orbits of 191, 186, and 181. This data is opposite of the student's conclusion, though. The more massive planets have moons with shorter orbital periods.

### Example of Score Point 3

a. Uranus is the planet I chose, the relationships between its moons and the orbital radius of orbit is close together that either means the more will move faster the closer it is. Such as

Miranda the orbital period is 1.4 earth days because the radius of the orbit is only 130 km.

b. I believe the student's conclusion is false for the reason of Andraستا is Jupiter's moon and it is on 0.3 Earth days for its orbital period and the radius is 129 km, as Uranus the less massive of the planets the smallest moon has an orbital period of 1.4 earth days and a radius of orbit 130 km. So this conclusion is false for the reason of bigger planets doesn't always mean longer orbits.

## Example of Score Point 2

A) Uranus has three moons Miranda, Ariel, & Oberon. M takes 1.4 days to orbit with a radius of 130 while O takes 13.5 with a radius of 584 it seems the moons that are closer take less time to orbit while the one that are further away take longer.

B) A planet with more mass has more gravitational pull resulting in more moons. The moon can either be really close meaning less days to orbit or further meaning more days to orbit.

### Example of Score Point 1

<sup>a</sup>Uranus has 3 moons; Miranda, Ariel, and Oberon. The Orbital period for Miranda is smaller because the radius of orbit is small. The relationship of the orbital period and the Radius of orbit is that if the orbital period is short then the radius of orbit will be small as well.

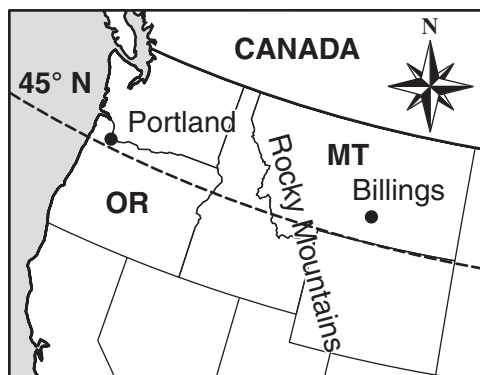
b. I support the conclusion because it is true. The Higher Mass the planet has then the size of the orbital period and the radius of orbit will be smaller or bigger

### Example of Score Point 0

Jupiter's moon Miranda has an orbital period of 1.4 and a radius of 130 km. So they aren't equal. The second moon Ariel has an orbital period of 2.5 and a radius of 191 km. It's not equal either. And the third moon Oberon has an orbital period of 13.5 and a radius of 584 km. They're not equal either. Therefore, the statement is false. The orbital period is NOT equal to the radius of the moon.

b) That is false. The mass of the moon has nothing to do with the orbital period. Because Miranda's mass is  $1.5 \times 10^{22}$  kg and an orbital period of 1.4, and Callisto has a mass of  $3.1 \times 10^{22}$  kg and an orbital period of 16.7, therefore the statement is true.

7. Portland, Oregon, and Billings, Montana, are both located just north of  $45^{\circ}$  N latitude, as shown on the map below.



Which statement **best** explains why Portland has far less snow in the winter than Billings?

- A. Portland is farther west than Billings.
  - B. The Sun sets in Portland after it sets in Billings.
  - C. The Pacific Ocean is closer to Portland than it is to Billings.
  - D. The city of Portland generates more heat than the city of Billings.
8. How do the cells of heterotrophic organisms get energy for cell processes?
- A. by breaking down food molecules to produce ATP
  - B. by copying the genetic information and dividing into two daughter cells
  - C. by combining carbon dioxide and water in the presence of sunlight to form glucose
  - D. by transferring the genetic information from the nucleus to the ribosomes to make proteins

9. Two different species of *Drosophila* fruit flies live in different ecosystems but have similar behaviors. Which statement **best** describes the two fruit fly species?

- A. They have identical DNA.
- B. They have similar genetic information.
- C. They are able to mate and produce live young.
- D. They would be the same species if they lived in the same ecosystem.

10. Why does a wooden spoon feel cool to a person using it to stir hot food?

- A. The spoon is kept cool by convection.
- B. The spoon is kept cool by conduction.
- C. Wood is a good thermal insulator.
- D. Wood is a good thermal conductor.

11. Antacid tablets are made of calcium carbonate ( $\text{CaCO}_3$ ). Calcium carbonate reacts with stomach acid according to the chemical reaction shown below.



If a 1.2-g antacid tablet is 12% carbon by mass, what is the mass of carbon in the reaction products?

- A. 0.14 g
- B. 1.10 g
- C. 1.20 g
- D. 1.30 g



12. Which unique feature of carbon explains why it is an important part of all biomolecules?

- A. Carbon can share one electron.
- B. Carbon can share two electrons.
- C. Carbon can share three electrons.
- D. Carbon can share four electrons.

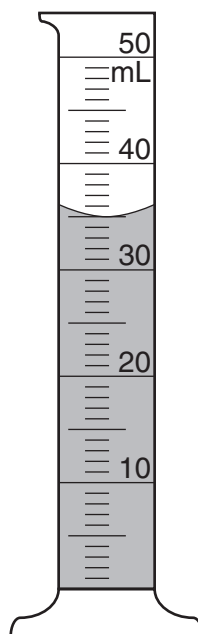
13. Students look at the night sky. Why are they seeing mostly stars within the Milky Way galaxy?

- A. Earth is located inside the Milky Way.
- B. The stars in the Milky Way burn brighter than other stars.
- C. There are more stars in the Milky Way than in other galaxies.
- D. Most stars in galaxies outside the Milky Way have burned out.

14. Which scientific discovery has challenged a commonly held understanding?

- A. Computers have given people access to ever-increasing amounts of information.
- B. Organisms in deep sea vents have been shown to use chemosynthesis to get energy.
- C. Blueberries have been shown to have extremely high quantities of antioxidants.
- D. DNA evidence suggests house cats and tigers share a common ancestor.

15. The liquid level in the graduated cylinder shown below was recorded by each member of a four-student team in the table below.



Student	Liquid Level Recorded (mL)
1	45.0
2	36.0
3	35.8
4	35.0

Which student recorded the data accurately in the table?

- A. Student 1
- B. Student 2
- C. Student 3
- D. Student 4

16. Which model **best** shows how information stored in a cell's nucleus is expressed in the cell?

- A. DNA → lipids → protein
- B. RNA → DNA → protein
- C. DNA → RNA → protein
- D. protein → DNA → lipids

17. A company develops a drug to lower blood pressure. The drug is tested on a small group of patients. The company claims the drug is effective at lowering blood pressure. Which step should the company take next?

- A. Produce the drug so other patients can benefit from the drug's effect.
- B. Repeat the experiment with a large group of patients to see if the result is the same.
- C. Repeat the experiment with a different drug to see if it is more effective.
- D. Publish the results in a scientific journal so other companies can make the drug.

18. The table below shows characteristics of five types of rocks.

**Characteristics of Rocks**

Rock Name	Texture	Foliation	Other
Gneiss	Coarse-grained	Foliated	Light and dark minerals
Marble	Fine- to coarse-grained	Non-foliated	White, pink, gray, or brown
Meta-conglomerate	Coarse-grained	Non-foliated	Deformed pebbles
Slate	Fine-grained	Foliated	Gray, black, red, or green
Quartzite	Fine- to coarse-grained	Non-foliated	Many colors possible

A student observes a rock sample and writes the following description:

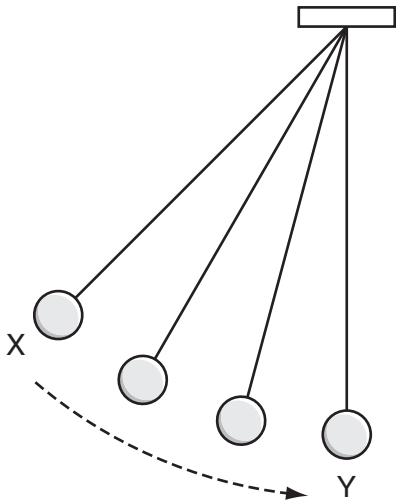
- gray
- no mineral layers
- no visible crystals

Based on this description, the student classifies the rock as quartzite. Why is this conclusion **not** necessarily accurate?

- A. The rock could also be gneiss.
- B. The rock could also be marble.
- C. The rock could also be metaconglomerate.
- D. The rock could also be slate.



19. The diagram below shows a pendulum swinging through an arc from its highest position (X) to its lowest position (Y) in a frictionless environment.



Which sentence describes the energy of the pendulum as it swings from position X to position Y?

- A. All of the potential energy of the pendulum is changed to kinetic energy.
- B. Half of the potential energy of the pendulum is changed to kinetic energy.
- C. All of the kinetic energy of the pendulum is changed to potential energy.
- D. Half of the kinetic energy of the pendulum is converted to potential energy.

20. Over 3 million years ago, the Pacific and Atlantic Oceans were connected between North and South America. A species of snapping shrimp was able to swim between the two oceans. How did the formation of a land bridge between the two continents **most likely** affect separated populations of the same species of snapping shrimp over time?

- A. They gradually became different snapping shrimp species.
- B. They found ways to cross the land bridge in order to mate.
- C. They began to migrate long distances to get to the opposite ocean.
- D. They gradually evolved into organisms belonging to different kingdoms.

21. Glaciers around the world are melting faster today than in the past. Which effect will be **most** directly related to increased glacial melting?

- A. Polar oceans will become less salty.
- B. Global temperatures will decrease.
- C. Earth's highest mountains will have drier climates.
- D. Earth's deserts will become windier.

22. Which of the following **most likely** drives the movement of Earth's tectonic plates?

- A. convection currents within Earth's mantle
- B. convection currents within Earth's oceans
- C. wind energy blowing across the continents' surfaces
- D. conduction of solar energy from the continents' surfaces

23. An organism uses carbon dioxide and water to begin a cellular process that produces a carbohydrate. What else is essential to start the process?

- A. heat
- B. oxygen
- C. soil
- D. sunlight

24. Which part of a star's life cycle is a fusion reaction?

- A. when a star explodes as a supernova
- B. when a star expels its outer material to form a white dwarf
- C. when helium atoms in a star's core combine to form beryllium
- D. when neutrons in a massive star's core collapse to form a black hole

25. Which list includes only abiotic environmental factors?
- A. wind speed, rainfall, air temperature
  - B. rainfall, presence of predators, disease
  - C. presence of prey, disease, grasses
  - D. wind speed, trees, air temperature

26. Which process occurs in a campfire?
- A. a physical change that releases heat
  - B. a chemical change that absorbs heat
  - C. a physical change that absorbs heat
  - D. a chemical change that releases heat

27. The table below is Mohs' scale of hardness. It is used to classify minerals.

Mineral	Hardness
Talc	1.0
Gypsum	2.0
Calcite	3.0
Fluorite	4.0
Apatite	5.0
Orthoclase	6.0
Quartz	7.0
Topaz	8.0
Corundum	9.0
Diamond	10.0

Glass has a hardness of 5.5. Which mineral can scratch glass?

- A. talc
- B. gypsum
- C. apatite
- D. orthoclase

